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Distribution of defective and spoiled material costs

C. H. Smith

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WOOLWORTH BUILDING
233 BROADWAY NEW YORK CITY

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Adapted from a paper presented before the Pittsburgh Chapter

C. H. SMITH
Director of Clerical Operations
Westinghouse Air Brake Co.

WOOLWORTH BUILDING
233 BROADWAY, NEW YORK CITY

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The following article is not intended to be an exhaustive treatment of defective and spoiled material but is a description of the actual treatment of this subject in one plant. The writer hopes, however, that the system outlined may suggest some practical ideas to men who are called upon to deal with this troublesome problem.

DISTRIBUTION OF DEFECTIVE AND SPOILED MATERIAL

One of the bugbears of the cost accountant in arriving at production costs is the problem of defective, spoiled, and rejected material. The cost of such material involves the loss not only of the material itself but also of the labor and overhead applicable thereto. The chief purpose of this article is to explain the cost accounting treatment of defective, spoiled and rejected material.

Defective and Spoiled Material Report

When the inspection of a piece of material reveals that it is defective or spoiled, Form No. 1 (see page 4) is filled out in duplicate, and signed by an inspector. The original is sent to the office of the department where the defect is discovered, and the duplicate is retained by the inspector. Each copy of Form No. 1 shows the following information:

1. Name of worker who calls attention to the defect and his check number
2. Date the form is made out
3. Number of pieces defective or spoiled
4. Number of pieces saved
5. Name of pieces, patterns, or drawing number; and the piece numbers
6. Cause of the defect
7. Last operation paid for on shop order
8. Shop order number on which work was being performed when defect occurred
9. Standing order number of the job, prefixed by the number or letter of the department against which the cost of replacement is to be charged.

On receipt of the above report in the department office, the clerk ascertains at once whether the defective or spoiled piece is a finished item for which no replacement order should be prepared, or is a piece in process which should be replaced ultimately. If it is a finished item, the clerk stamps across the face of the form "Finished Material," and then sends it to the Cost Department, where the record of available material on the stock record is reduced by the amount shown. Before this reduction is made, however, the value of the material is carefully calculated for the record of defective and spoiled material. If the defective or spoiled item is a piece in process which must be replaced ultimately, the clerk makes a proper note of the fact on Form No. 2, Record of Work Performed (see page 8). This record should also show the number of pieces under the "Operation Number," the letter or numeral which designates the department, and the expense order number. The record is then forwarded to the Cost Department.

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MACHINE NO._____ SERIAL NO._____

DEPT. NO. NAME DATE

MATERIAL DEFECTIVE TO BE REPLACED OR REMACHINED

NO. OF DEFECTIVE PIECES	NAME OF PIECE	PATTERN AND PIECE NO.	CAUSE OF DEFECT	LAST OPERATION PERFORMED	REPLACEMENT ORDER NO.	STOCK ORDER NO.
		PARTS SCRAPPED				
		PARTS SAVED				

REMARKS_____

INSPECTOR

If the shop clerk notes at the time Form No. 1 is passing through his hands that no piece or premium work wages apply to the items involved, he immediately consults the foreman and estimates the value of the labor that has been lost, and enters the estimate on his copy, before he sends it to the Cost Department.

Record of Work Performed, Material Consumption Card and Workman's Order Sheet

After an order has been completed, the time clerks add up the defective and spoiled material columns on Form No. 2 and make requisitions for whatever material and labor are necessary to make replacements. Requisition Form No. 3 (see page 6) is used for the material and workman's order; and Form No. 4 (see page 7) for the labor. The latter shows the number of pieces to be brought through on each operation. Both of these forms show the stock order number on which the work was found defective but contain no reference to the expense order numbers. After the necessary material has been drawn to replace the defective or spoiled pieces and the necessary labor has been performed on the operations as called for by Form No. 2, the material costs are then applied to the regular order. All requisitions, Form No. 3, made for replacement material must have the word REPLACEMENT stamped or written on the face of the card. As time is turned in for work performed, the time clerks check the amounts for which the replacement (Form 4) was issued on each operation.

Replacement Orders

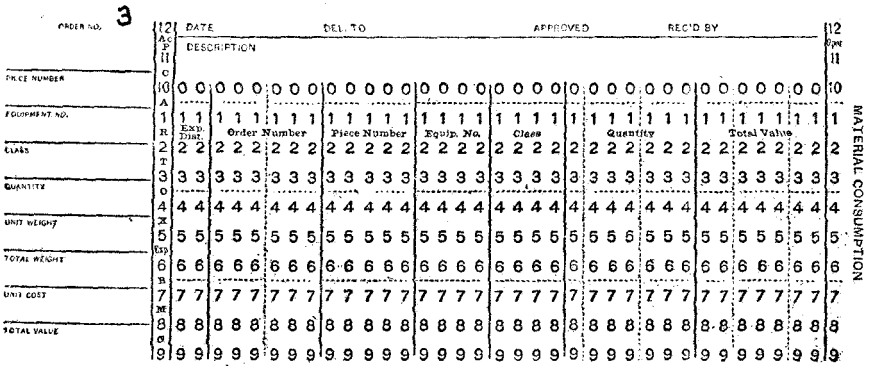
When an order is completed, the amounts recorded on Form No. 2 for material machined or manufactured in another department must be transferred to Replacement Order Form No. 5. Enough copies are made to supply each department which has work to perform or material to replace. This Replacement Order shows the following information:

1. Drawing number
2. Piece number
3. Stock order number on which material was being manufactured when found to be defective or spoiled
4. The quantity to be replaced
5. Name of articles
6. The date of issue
7. The letters or numbers of the departments to which the replacement order is issued

As soon as this order is made out, it is forwarded to the department for which it is intended and a copy is filed in the department office. A copy is sent also to the Cost Department.

Order Record Card

Upon receiving a replacement order, the department clerk immediately posts it in red ink to the Order Record Card, Form No. 6 (see page 11), using the same card to which stock orders are posted, and also makes out a new Form No. 2, so that the time can be checked and corrected when received from the workman. When it is time to make replacement, the Replacement Order is referred to, and all material shown thereon, as required, is ordered on a Material Consumption Card, Form No. 3. It also becomes necessary then to fill out Form No. 4 to cover the work to be performed under the different operations, charging both labor and material to the original stock order numbers as shown on the Replacement Order. When the material has been machined and full credit taken, the Replacement Order is marked "Completed" and is returned to the department where it originated. After it has served its purpose there, it is forwarded to the Cost Department for filing.

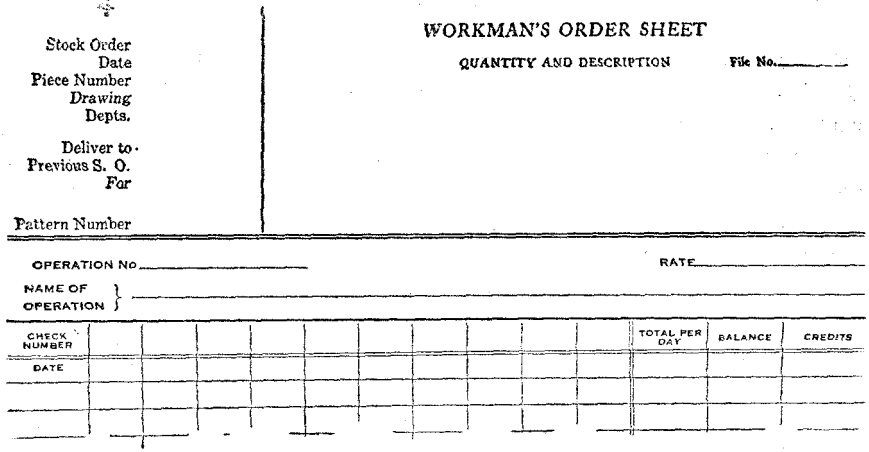


Replacement Tag

A Replacement Tag, Form No. 7 (see page 12), is filled out in the storeroom or any department which delivers new material to take the place of defective or spoiled material. This tag is attached to each lot or amount delivered to another department. All blank spaces on the tag are filled in properly and care is exercised to see that all information called for is given. These tags must not be removed until the material reaches the operation where it is applied to the stock order which is then being worked on.

MATERIAL TRANSFER

Material transferred from one department to another is entered on a Department Transfer Slip, Form No. 8 (see page 13), by the person who receives the material. He fills out on the transfer slip the same information that appears on the Replacement Order, Form No. 5, and writes his initials in the "Received By" space. Form No. 8 is prepared in duplicate. The original is sent to the office of the department to which material has been delivered, and the duplicate is returned by the hauler or trucker to the office of the department from which the material was delivered.



When partial delivery of material has been made on a Replacement Order, and the duplicate Material Transfer Slip has been returned to the department which has originated the transfer of material, the latter form is attached to the former. By keeping these forms together the balance to be delivered on the order at any time can always be readily ascertained. When full credit has been taken on a Replacement Order, the Material Transfer Slip is forwarded to the Cost Department, where it is filed. These credit slips may be retained in the Cost Department for as long a period as is deemed necessary.

When material is required from the storesroom to replace defective or spoiled material, the shop clerk makes out a Material Consumption Card, Form No. 3, using the stock order number that was being worked on when the material was found to be defective. The charge made against this order for defective or spoiled mate-

2

RECORD OF WORK PERFORMED

DESCRIPTION.....

DATE..... DEP'T..... QUANTITY..... DWG. NO..... PAT. NO..... PC. NO..... ORDER NO.....

OPER. NO..... RATE.....							DEFECTIVE & SPOILED		OPER. NO..... RATE.....							DEFECTIVE & SPOILED		OPER. NO..... RATE.....							DEFECTIVE & SPOILED	
DATE	CK. NO.	TIME HRS.	TIME MIN.	QUANTITY	BALANCE		DEPT. CHARGE	QUANTITY	DATE	CK. NO.	TIME HRS.	TIME MIN.	QUANTITY	BALANCE		DEPT. CHARGE	QUANTITY	DATE	CK. NO.	TIME HRS.	TIME MIN.	QUANTITY	BALANCE		DEPT. CHARGE	QUANTITY
TOTAL																										

terial is shown on Form No. 2. A Replacement Tag, Form No. 7, is filled out in the storesroom for all material furnished by the storesroom for replacement purposes.

If a piece of standard apparatus is found to be defective or is spoiled in assembling, a duplicate part is drawn from stock and charged to expense. The labor involved in dismantling and reassembling the apparatus is charged to a standing expense order (No. 164), as indicated on the Replacement Tag.

When an order or contract is reduced for any reason to the quantity that already has been completed, replacements become necessary and the departments which have additional work to perform on account of defective or spoiled material are so advised. In such cases the orders are passed to the stock record clerks so that the available amounts can be corrected.

Inspectors who fill out Form No. 1 must consider the following for the use of the Cost Department which makes the proper charges for defective and spoiled material:

1. The cost of material when due to foundry defects is charged to either the brass or iron foundry, as the case may be
2. The labor on defective castings is charged to the department in which the defect is found
3. If purchased material proved defective the lost labor is charged to the department expense order No. 162 in which the work is found to be defective
4. The actual cost of the material is charged to the Material and Supplies account.

When purchased material is returned to the vendor and a credit is received, the Material and Supplies account is credited. Occasionally it is necessary to estimate the value of the material returned. When this is done, the estimate is a matter of record. When the credit is received it is compared with the estimate, and an adjustment is made if necessary. Replacements of spoiled work and defective material are made in the same manner except that the letter or number of the department which spoils the work is used in conjunction with a standing expense order, and is charged for both labor and material involved in replacing spoiled work.

Reclaimed Material

When material in the course of machining, assembling, or testing, is found to have a defect that can be repaired regardless of whether it is due to defective material or bad workmanship, the departmental inspector fills out Form No. 5 and delivers it to the department office. The clerk then assigns it a serial number for purposes of identification, and fills out Form Nos. 2 and 7. To Form No. 2 he posts the number of pieces as shown on Form No. 5, which is the Replacement Order. The inspector then attaches the Replacement Tag, Form No. 7, to the material and delivers it to the department and operation where work is to begin. The Replacement Order is delivered to the office of the same department. When several departments have operations to perform on the piece to be reclaimed, each one receives a copy of the Replacement Order. Each department which receives a copy of this order is required to make out Form No. 2 in order to show the amount of work performed. All of the time turned in on the reclaimed

order is recorded on this form. All labor performed or material used in connection with a reclaimed order is charged to a standing expense order (No. 164), which is preceded by the letter or number of the department that is responsible for the defect.

In order to keep the records straight and to avoid confusion, all forms used in connection with reclaimed material should carry a serial number which is assigned by the department that makes the original order.

Work of the Cost Department

On receipt of Form No. 1, the Cost Department calculates daily the labor and material costs. This data is punched on tabulated cards. Both labor and material is tabulated by departments.

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SERIAL NO._____ DRAWING NO. _____ PAT. NO._____ PIECE NO._____

EPT._____ PLEASE REPLACE TO DEPARTMENT_____

QUANTITY	NAME OF ARTICLE_____					
REPLACEMENT ORDER NUMBER				CREDITS		
QUANTITY	LETTER	ORDER No.	STOCK ORDER No._____	TO DEPT.	QUANTITY	DATE
			DATE MADE OUT_____			
			DATE RECEIVED_____			
			DATE MATERIAL ORDERED_____			

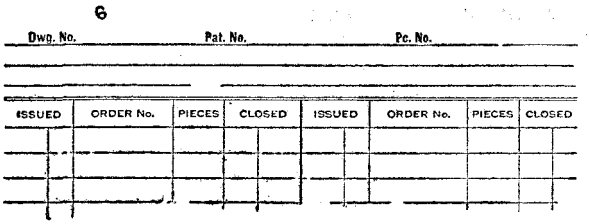
WHEN FINAL DELIVERY IS MADE RETURN THIS ORDER TO ORIGINAL DEPARTMENT.

The labor is posted by departments to the Payroll Distribution Sheets. The columnar arrangement of the Payroll Distribution Sheet is as follows:

1. Department No.
2. A—Orders
3. R—([1])
4. C—etc.
5. Total Production Orders
6. Adjustment Account Replacements Expense
7. Net Productive Labor

(1) R, C and several other letters are used to indicate the different classes of production orders.

8. Net Shop Expense
9. Manufacturing Material and Supplies
10. Estimate Shop Expense
11. Betterments
12. Maintenance
13. Total
14. Miscellaneous Orders
15. Development
16. Foundry Iron
17. Foundry Brass
18. Expense
19. Adjustment Account Replacement Expense
20. Total Expense
21. Total Payroll



Another form filled out in connection with labor distribution is the Supplement to the Payroll Distribution Sheet. It is provided with the following columns:

1. Department No.
2. Expense Labor
3. Charge from No. 444 (2) Replacements—Deduct from Productive Labor and Charge Expense Labor
4. Charge from Daily Time Sheets—Deduct from Expense Labor and Charge Productive Labor
5. Credit Expense—Charge Productive Labor
6. Credit Productive Labor—Charge Expense
7. Total Expense Labor

The net difference between amounts is written at the top of the form over the series of columns.

The labor posted by departments is deducted from the gross productive labor giving a net productive labor total on which the estimated overhead is to be calculated. The net productive labor

(2) This is simply the code number.

is then entered again on the same sheet in a column next to the expense labor and the two columns are added to show a net expense labor. The same general procedure is followed in the case of material which is entered in the Material and Supplies account and on the Supplement to Material Distribution. The Material and Supplies account kept for Cast Iron, for example, shows both the weight in pounds and the value of the opening inventory, production, and consumption for the period, and any necessary adjustments. The Supplement to Material Distribution has the same columns as the Supplement to Payroll Distribution except that the word material appears in the place of the word labor; and material (Dual Card) in place of daily time sheets. The tabulated cards are then sorted according to the expense order number, and the totals for the various departments are charged to the detail sheets. Then the tabulated cards for both labor and material are sorted by order numbers on which defects were found and the total amount is posted to the labor and material sheets respectively for each order.

In calculating the cost from Form No. 1, and in making a charge to the Foundry for defective castings, the Material and Supplies account is debited with the scrap value of the castings, and the Foundry Expense account is charged with the loss. When the Foundry draws the castings for remelt, they are charged to it at scrap value and the Material and Supplies account is credited. The same procedure is followed in the case of spoiled work, that is, the Department Expense is charged with the difference between the unit cost of castings and their scrap value.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REPLACEMENT

Date 19

Quantity

Description

Stock Order No.

Piece No.

Pattern No.

Drawing No.

STOREROOM OR DEPARTMENT'S

Replace to Dept.

Remove Tag at Oper. No.

RECLAIMED

Serial No.

Quantity	Dep't Letter	Order No.
		164
		164
		164

Note See other side

After an order is closed and it is found from the Defective and Spoiled Report (Form No. 1) that replacements have been made and charged to the stock order, the Cost Department deducts from the value of the labor and material in each department the totals of the defective and spoiled material columns as shown on the Record of Work Performed (Form No. 2). This gives the correct unit cost since the amounts in the defective and spoiled material columns have been previously charged to expense. After the order is completed, it is entered on the Record of Shop Cost and Material

Required to Manufacture or Assemble One of Piece No. This record has the following columns:

1. Stock order
   a Description of material
2. Number and amount
   a Labor and indirect cost
   b Material cost

8

MATERIAL TRANSFER

DELIVERED TO DEPT. ..... BY DEPT. ..... DATE ..... 19 ....

DWG. No. ..... Pc. No. ..... ORDER No. .....

QUANTITY	DESCRIPTION	CLASS	UNIT PRICE		AMOUNT	

OPERATION .....

BALANCE DUE ON ABOVE ORDER .....

RECEIVED BY ..... TRUCKER .....

DATE ..... FOREMAN .....

These columns are repeated a number of times in order to save space and investment in stationery. At the bottom of the Stock Order column is a summarization section which shows the following data:

1. Labor charge
2. Total labor
3. Total indirect charge
4. Total material
5. Total shop cost

The record shows not only the material, labor, and overhead cost but also the expenses for defective and spoiled material for each stock order. The latter is entered in red ink, since it is intended only for reference and is not figured in the unit cost.

In calculating the loss due to Defective and Spoiled Material from Form No. 1, the Cost Department uses the "unit cost." In the case of brass castings, the unit cost does not include the turnings. If no work has been performed on the castings, the "rough weight" of course is used.

At the end of each month the total brass scrap calculated from Form No. 1 for both defective and spoiled work is charged to Material and Supplies Brass Scrap account which shows both the quantity and value of the scrap. The Work in Process account

is credited. When the physical brass scrap is delivered to the material and supplies storeroom, the Cost Department makes no record, since this has already been done from the replacement slip. When the smelter draws the brass scrap from the storeroom, however, the Cost Department uses the actual weights in crediting the Brass Scrap account and in charging the Smelter. It is very necessary, therefore, that an inventory be taken from time to time of the brass scrap in stores in order to make any adjustments that are necessary on account of discrepancies between the calculations on the replacement slip, Form No. 1, and the actual weights.

In calculating from the replacement slips for material in which brass castings are used, care is observed in seeing that the finished weight is used. Otherwise an adjustment is necessary to take care of the turnings.

As far as iron castings are concerned, the same procedure is followed except that the calculations are based on the rough weight of the castings, and furthermore no book record or inventory is taken in order to trace discrepancies because of the small value involved.

Castings and Scrap Value Adjustments

All castings are charged to the Material and Supplies account at actual cost per pound for which they were produced during month.

A ledger account is kept of the average cost so that any necessary adjustments between the average cost and the estimated cost used in making estimates and in pricing requisitions can be made. This account is used in making up costs on completed pieces of product.

The total weight and value of the stock of castings is secured from an inventory and the average pound cost is calculated. To these amounts as shown on the ledger, is added the total month's production and a new average of the castings is determined.

When castings are drawn into the shop for use on orders, they are charged to Work in Process accounts at estimated costs, which are secured from the record of piece work prices of molding and core-making for that particular piece, and average costs for metal and other expenses. The Material and Supplies account is also credited with this amount. The requisitions on which the castings are drawn show not only the quantity of a particular casting, but also the total weight.

After the above records are made, the value of the month's consumption at the actual cost of the castings per pound is figured

and the difference between what is charged to Work in Process at estimated cost and what should have been charged at actual cost is determined.

If the value of the castings consumed at the estimated cost is *greater* than their value at *actual* cost, it is readily apparent that the Material and Supplies account has been overcredited. Therefore, this account is debited with the above difference.

It is the practice in crediting Work in Process and in charging Cost of Shipments with the value of shipments, to use the estimated cost of castings. If all finished stores have been shipped there are no unnecessary values in the Work in Process or Finished Stores accounts.

Any adjustment, therefore, should pass through the Cost of Shipments account. In the case mentioned, the Cost of Shipments account would be credited with the same value that is charged to the Material and Supplies account when the estimated cost is greater than the actual cost.

Likewise, if the value of the castings consumed at the estimated cost is *less* than the actual cost, the Material and Supplies account would be credited and the Cost of Shipments account would be charged with the difference.

The castings ledger account also shows the adjusting amount as mentioned above. Similar ledger accounts are carried for both brass and cast iron foundries.

In estimating the cost of cast iron castings, no allowance is made for turnings and scrap, and consequently the value secured from their sale is a credit to the Cost of Shipments account, since the full value of the casting is included in the unit cost and therefore is cleared out of Work in Process and Finished Stores account in the usual manner.

As far as brass castings are concerned, it is necessary to handle the scrap in a different manner, because it is found in the machining of brass castings that the scrap varies from 40 to 70%. Since its value is a considerable item, it should not be included in the unit cost of the casting, but an allowance should be made in the unit cost to cover the scrap value.

In estimating the cost of a piece in which brass is used, assume that the rough weight of the casting is 2.68 pounds and the cost is .3535 per pound, which equals .9474, as illustrated on page 16. The finished weight of the piece is 1.25 pounds; or, in other words, 1.43 pounds of brass scrap would be secured if nothing were lost in cutting or in sweeping. The experience in the

writer's plant shows that at least 3% of such scrap is lost in machining and handling, or .0429 pounds in the present instance. Assuming that the price of scrap is .1715 per pound, there would be a weight of 1.39 per pounds or a scrap value of .2394, which, deducted from the value of the rough casting, would give .708 as the unit cost of the material. This amount should be used in figuring the cost of the order.

1 Casting T100

Rough weight	2.68 lbs. @ .3535 =	.9474
Finished weight	1.25	
	1.43 lbs. @ .1715 =	.2394
		.708

The price of scrap is based on 60% of the average price of material during the month as secured from the "Metal Market" figures.

In charging brass castings to Work in Process account the total weight of the consumption is used. An *estimated* average cost is calculated. The difference between this figure and the actual cost is determined as in the case of Cast Iron. Similar adjustments are made.

In pricing production and shipments for credits to Work in Process and Finished Stores account in which brass castings are used, the unit cost of the casting less the allowance for scrap is used. Scrap is delivered to Material and Supplies constantly and at the end of each month Work in Process account is credited with the value of the scrap and Material and Supplies account is charged. When the scrap is drawn out by the smelter or foundries, the Material and Supplies account is credited.

Occasionally in the sale of scrap, a certain amount can properly be credited partly to expense and partly to production. No cost is reported against that portion which is a credit to production. That part which is a credit to expense is so credited by the Cost Department. This same amount is used as the "Scrap Cost of Shipments."

The General Accounting Department reduces the total scrap sales by the "Scrap Cost of Shipments." The net total is used to reduce the Manufacturing Profit on the Operating Statement. Thus, the revenue secured from Sales of Scrap is used to reduce the Manufacturing Profit, instead of being treated as a Miscellaneous sale.